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ABSTRACT

This study was initiated to evaluate a Kindergarten unit on the environment and associated pollution problems. The research design was a modified rotation design, permitting each group to act both as a control and experimental group. Two groups (each involving 17 students) were used in the study. The data indicated that many Kindergarten children can form concepts concerning issues and citizenship responsibility. The writers speculate that the instructional procedures used in this unit hold promise for use with other similar groups. (RH)

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AN ANALYSIS OF STRATEGIES FOR TEACHING ENVIRONMENTAL CONCEPTS AND VALUES CLARIFICATION IN KINDERGARTEN *

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Introduction and Research Questions

The writers have been able to identify no empirical studies dealing with environmental education concept formation and values clarification with respect to kindergarten children. If one assumes the necessity for formal instruction dealing with the environment and related issues and implementing said instruction at an early age as possible, the importance of such research becomes apparent.

This particular study was initiated in an effort to evaluate a one-month kindergarten unit on the environment and associated pollution problems used by the senior author in the Carbondale, Illinois elementary schools during the 1975-76 school year. Three research questions were posed for the study:

1. Will kindergarten children who have experienced the environmental education unit identify a significantly greater number of environmental problems than children receiving a control treatment?
2. Subsequent to the identification of environmental problems which they perceive as important, will kindergarten children be able to verbally communicate personal responsibilities (value positions) relative to those problems?
3. Subsequent to the identification of environmental problems which they perceive as important, will kindergarten children be able to verbally communicate the responsibilities of other people (value positions) relative to those specific problems?

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* - A complete record of all data, instructional models, instruments, and statistics associated with this research is available as an unpublished Masters Thesis of the same title written by the senior author at Southern Illinois University at Carbondale (62901), 1976.

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The Independent (Experimental) Variable

The independent variable in this study was a kindergarten instructional unit dealing with three environmental problems. It was developed by the senior author as part of a curriculum development project in environmental education at SIU-C. This unit was initiated with an Introductory Module dealing with the term environment and the environment's living and nonliving parts. The Introductory Module familiarized the students with the vocabulary associated with environment and permitted them to synthesize a concept of environment. In the opinion of the writers, this Introductory Module is both a readiness factor and a key element in the eventual success of the entire unit. The Introductory Module lasted one week.

The remainder of the unit took three weeks to accomplish and was divided into three segments. These segments dealt with the topics of air pollution, noise pollution, and solid waste problems. In each segment, instruction was activity oriented, e.g., discrimanting between loud and quiet sounds, observing auto emissions, making bulletin boards on littering. Similarly, performance objectives for each segment were written and evaluated.

The Dependent Variable (Evaluation Instrument)

The evaluation assessment used in this study was composed of a four question instrument. These questions were asked of each child individually, in private, and responses were tape recorded for future analysis. These questions were:

1. What new things have you learned in our study of the environment? (This question was posed to children immediately after the Introductory Module.)
2. With which parts of the environment do we have problems?
3. What do you think you should do about these problems?
4. What do you think other people should do about these problems?

The instrument was initially submitted to a panel of three science and/or environmental education specialists for validity purposes. Each agreed independently that the instrument appeared to measure what it purported to measure and that it was consistent with the instructional objectives of the unit.

Each question was scored in a similar manner. For each question in the instrument, discrete responses which were germane to that question were given one point each. Care was taken to assign point values only if the responses reflected separate conceptual referents. For example, if a student response to Question 3 was, " . . . ride a bike and tell my parents not to burn trash," the response would be assigned two points because of the two separate references to things he could do to help alleviate air pollution. If, however, that student's response had been, " . . . tell my parents not to burn trash or leaves," the response would have received only one point because the burning concept was felt to be the critical issue, not the modifiers.

Although of a phenomenological and subjective nature, the instrument appears to have excellent test-retest reliability. Such reliability is confirmed by referring to the t values for the differences between Group I means ($O_1 - O_2$) for Questions 2, 3, and 4 (please see Figures 2, 3, and 4). Question 1 does not appear in this analysis because it was used only at the close of the Introductory Module for group equation and evaluation purposes.

The Research Design

The research design used was a modified rotation design, permitting each group to act both as a control and experimental group. The modification of this design came in the context of the Introductory Module which was given to both groups at the beginning of the study. The use of the Introductory Module was necessary in order to introduce the students to the vocabulary that would be used in the assessment instrument. The design is depicted in Fig. 1.

Fig. 1, Research Design.

Weeks:	0	1	2	3	4	5	6	7
Gp. I (N=17)	I.M.	O_1	C (No EE Instruction)		O_2	X		O_3
Gp. II (N=17)	I.M.	O_4	X		O_5	C (No EE Instruction)		O_6

Where: I.M. = Introductory Module
X = Independent Variable
C = Control Treatment
O_n = Administration of Evaluation Instrument

The rotation design used in this study helps maximize the potential of the research findings. A rotation design permits the researcher to use two experimental groups even though there are only two groups available for manipulation. This can be successfully accomplished only because the control treatment (C) does not involve any instruction in environmental education. The control treatment used in this study reflected only typical kindergarten instructional activities with no formal instruction being given with respect to environmental issues.

Data Analysis

Data were analyzed for Question 1 at $O_1 - O_4$ (see Fig. 1) only because, in the opinion of the researchers, the data were pertinent only for the Introductory Module. Groups I and II were the two kindergarten classes taught by the senior author. They had to be utilized as they were assigned to these classes by the school's administration. Because students were not randomly assigned to Gps. I and II, the $O_1 - O_4$ assessment would determine whether the groups could be equated on at least a portion of the instrument. The researchers were able to assume that the groups were similar based on a t value of only .797 for the difference between the mean responses, $O_1 - O_4$, where t critical (.01 level) = 2.449 with 32 degrees of freedom.

The statistical analysis of data collected for Questions 2, 3, and 4 can be found in Figures 2, 3, and 4 below. Each question is analyzed separately. All control and experimental data are presented. This permits the interpretation of data both before and after the two groups were rotated, i.e., the experimental group becoming the control group and the control group becoming the experimental group.

Fig. 2, Statistical Analysis of Data Collected for Question 2: With which parts of the environment do we have problems?

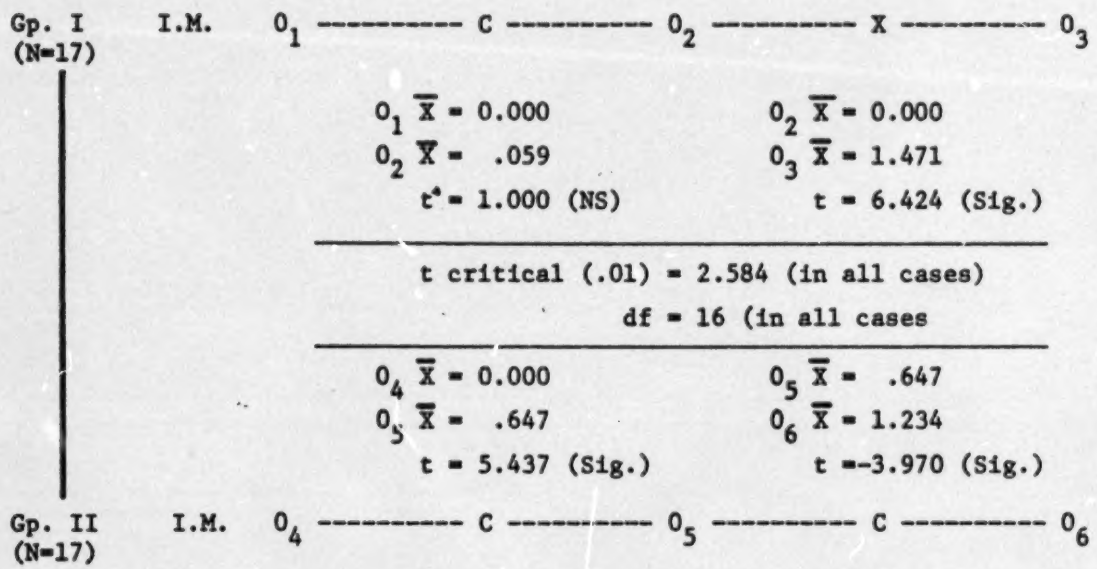
Gp. I (N=17)
I.M. O_1 C O_2 X O_3
$O_1 \bar{X} = 0.000$
$O_2 \bar{X} = .059$
t = 1.000 (NS)
$O_2 \bar{X} = 0.000$
$O_3 \bar{X} = 1.471$
t = 6.424 (Sig.)
t critical (.01) = 2.584 (in all cases)
df = 16 (in all cases
$O_4 \bar{X} = 0.000$
$O_5 \bar{X} = .647$
t = 5.437 (Sig.)
$O_5 \bar{X} = .647$
$O_6 \bar{X} = 1.234$
t = -3.970 (Sig.)
Gp. II (N=17)
I.M. O_4 C O_5 C O_6

Fig. 3, Statistical Analysis for Data Collected for Question 3: What do you think you should do about these problems?

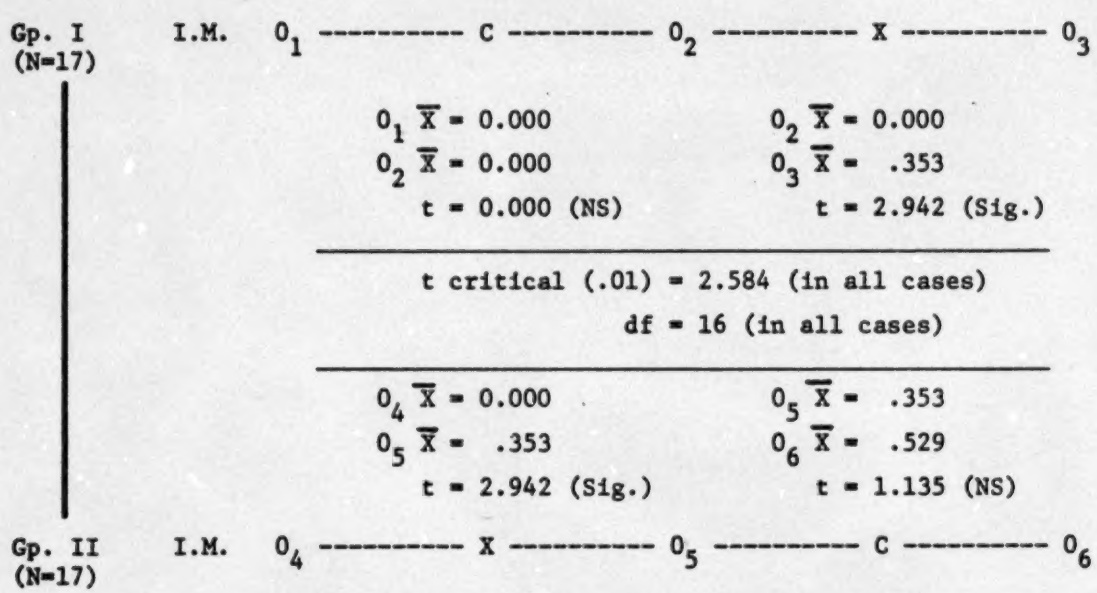
Gp. I (N=17)
I.M. O_1 C O_2 X O_3
$O_1 \bar{X} = 0.000$
$O_2 \bar{X} = 0.000$
t = 0.000 (NS)
$O_2 \bar{X} = 0.000$
$O_3 \bar{X} = .353$
t = 2.942 (Sig.)
t critical (.01) = 2.584 (in all cases)
df = 16 (in all cases)
$O_4 \bar{X} = 0.000$
$O_5 \bar{X} = .353$
t = 2.942 (Sig.)
$O_5 \bar{X} = .353$
$O_6 \bar{X} = .529$
t = 1.135 (NS)
Gp. II (N=17)
I.M. O_4 X O_5 C O_6

Fig. 4, Statistical Analysis for Data Collected for Question 4: What do you think other people - like adults - should do about these problems?

Gp. I (N=17) I.M. O_1 ---------- C ---------- O_2 ---------- X ---------- O_3

$O_1 \bar{X} = 0.000$ $O_2 \bar{X} = 0.000$

$O_2 \bar{X} = 0.000$ $O_3 \bar{X} = 1.118$

$t = 0.000$ (NS) $t = 5.915$ (Sig.)

t critical (.01) = 2.584 (in all cases)

df = 16 (in all cases)

$O_4 \bar{X} = 0.000$ $O_5 \bar{X} = .706$

$O_5 \bar{X} = .706$ $O_6 \bar{X} = .882$

$t = 4.937$ (Sig.) $t = 1.135$ (NS)

Gp. II (N=17) I.M. O_4 ---------- X ---------- O_5 ---------- C ---------- O_6

Conclusions and Implications

With the exception of one Group II t value (Question 2, $O_5 - O_6$), all t values support an affirmitive response to the three research questions. Further, $O_5 - O_6$ is, in essence, a measure of retention as well as a control treatment due to the rotation of the original experimental group (Gp. II). The significant t value for Question 2, $O_5 - O_6$, at first appears discrepant but the researchers are confident in hypothesizing that the Gp. II students continued to synthesize what they had learned during the instruction phase and that this synthesis permitted them to perform significantly better on the retest (O_6) than on the original posttest (O_5).

One might question the veracity of this hypothesis when it is weighed against the nonsignificant differences observed for Questions 3 and 4 ($O_5 - O_6$). However, Questions 3 and 4, unlike Question 2, are related to citizenship responsibilities concerning environmental issues, not the direct acquisition of conceptual knowledge about those issues. The cognitive differences between Question 2 and Questions 3 & 4 could account for the observed phenomenon.

Given the data which were collected during this research, it is apparent

that many kindergarten children can form concepts concerning issues and citizenship responsibility with respect to those issues. This, in itself, is a finding of significant proportions since the paucity of literature dealing with this kind of instruction at the kindergarten level suggests that such instruction is not commonly attempted.

The successful generation of concepts and inferred values may well be a function of the instructional design developed for this research. It appears as though the instructional procedures used were adequate to impart the desired knowledge and to stimulate young children to think about their own responsibilities and the responsibilities of others. Of considerable importance may be the module used to introduce the children to the concept of "environment" prior to any instruction concerning environmental issues. This readiness strategy, which provides children with critically important vocabulary and concepts, may well be one of the key variables needed to permit kindergarten teachers to become emphatically involved in environmental education.

The writers are certainly willing to speculate that, since this procedure was successful with the samples used, it holds promise for use with other similar populations at least.

The question of values clarification with respect to environmental education is one of considerable importance. Although this study only identified those values held by five year olds at a verbal level of commitment, it is significant that these children could identify actions that they themselves could take. It was further observed that many of the children were able to identify actions which others, i.e., adults, could take. Of great interest is the observation that when the childrens' responses to Questions 3 and 4 were analyzed, the responses to Question 4 were often quite different than those to Question 3. This indicates a cognitive analysis of the issues that went beyond a simple one-answer solution. Many of the children had been able to distinguish between those actions which they could take and those options available to adults. This implies that environmental education at the kindergarten level can result in some fairly sophisticated behavior on the parts of the students involved.